

## Non-Inverting Level Shifter Requires Only One Op Amp, One Supply Voltage

### Highlights

- Audio/video in a one-supply design can be hard when ground-referenced signals must be shifted up.
- Instead of using two op amps and a negative rail,

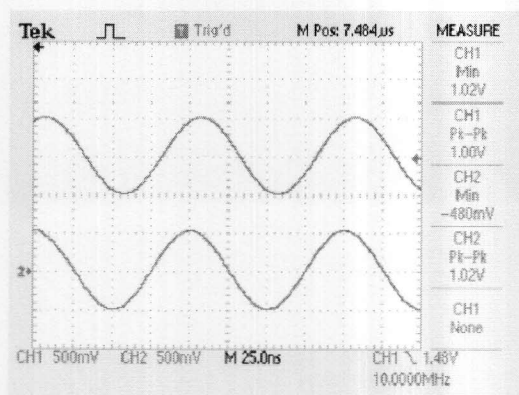
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With portable battery-operated devices continuing to add functionality while shrinking in size, printed-circuit-board real estate becomes increasingly valuable. Single-supply circuitry can help by saving space and cost. Adding audio or video, however, may pose a problem because those signals are usually referenced to ground, and most single-supply ICs must be configured for signals above ground.

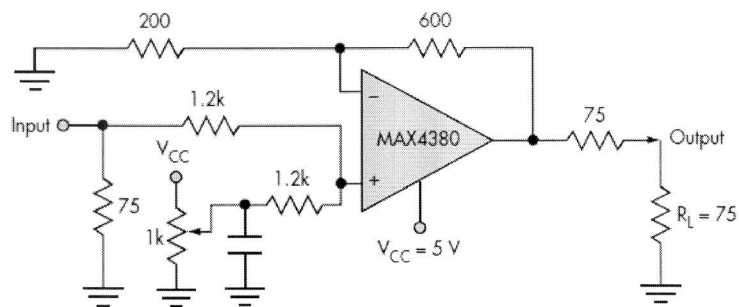
Therefore, the circuit must shift most audio or video input signals to an appropriate level above ground. Also, polarity must be preserved for video signals. Unfortunately, using a single-supply voltage while preserving signal polarity is impossible with traditional op-amp level shifters, which require two op amps and a negative rail.

The circuit in *Figure 1* meets all of these requirements, level-shifting a ground-referenced signal with one op amp while running on a single-supply voltage. The op amp's non-inverting summing configuration creates the level-shifted output by summing a reference voltage with the input signal. A standard potentiometer with a bypass capacitor sets the reference voltage, but any voltage reference able to provide enough bias current for the op amp and summing resistors will suffice.

This example circuit includes the 75- $\Omega$  termination resistors required in a standard video application. The op amp shown features a small footprint plus the wide bandwidth needed for video. *Figure 2* shows the circuit's operation, shifting a 10-MHz ground-referenced input signal by +1.5 V.



2. The blue trace (bottom) is the circuit's 10-MHz ground-referenced input signal and the yellow trace (top) is the output, which is level-shifted by +1.5 V.



1. This non-inverting level shifter allows designers to shift the input signal by a reference voltage, which is determined by the potentiometer and bypass capacitor. The circuit uses only one op amp and one supply voltage.

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